AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions of claims in the application. Claims 1, 11, 21, 33, 38-40, 57, 69, 80, and 81 have been amended herein.

1. (Currently amended) A method for processing frames of streaming data through modules in a digital computer, comprising:

constructing a graph as a sequence of the modules for accepting and processing the frames of streaming data to achieve desired output data;

dividing the graph to define a pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules, at least one of the modules being a restructuring module and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules;

providing a common memory area accessible to the modules within the pipe for storing streaming data;

constructing a composite frame nesting tree specifying composite frames comprising nested subframes;

allocating composite frames in the common memory area in accordance with the composite frame nesting tree, wherein the allocating of the composite frame includes a frame control table having an entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe;

setting the flag whenever the particular module has completed the operation upon the particular subframe;

transporting the streaming data through different ones of the modules in the group in different ones of the subframes; and

restructuring the data among at least some of the subframes in the restructuring module.

2. (Previously presented) A computer readable medium having computer executable instructions for a digital computer to perform steps comprising the method of claim 1.

3. (Previously presented) The method of claim 1 where the composite frame is a physical frame in the common memory area.

4. (Previously presented) The method of claim 3 where the subframes are virtual frames defined in the common memory area.

5. (Original) The method of claim 1 further comprising assigning an allocator for the composite frames to one of the modules in the pipe.

6. (Previously presented) The method of claim 5 where the allocator is assigned to a farthest upstream restructuring module in the pipe.

7. (Previously presented) The method of claim 5 where the allocator is assigned to a farthest downstream restructuring module in the pipe.

8. (Previously presented) The method of claim 1, wherein the composite frame nesting tree specifies how the data is to be restructured in the restructuring module.

9. (Canceled).

10. (Original) The method of claim 1 where transporting the streaming data includes issuing a control transaction to the restructuring modules only when all of the sub frames processed by that module become available.

11. (Currently amended) A method for processing frames of streaming data through multiple modules disposed in a pipe in a digital computer, comprising:

constructing a graph as a sequence of the modules for accepting and processing the frames of streaming data to achieve desired output data;

dividing the graph to define the pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules, at least one of the modules being a restructuring module and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules;

constructing a composite frame nesting tree specifying a composite frame comprising multiple nested subframes;

allocating a composite frame in accordance with the composite frame nesting tree, wherein the allocating of the composite frame includes a frame control table having an entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe;

setting the flag whenever the particular module has completed the operation upon the particular subframe;

performing operations upon the subframes in any of the modules sourcing data to the restructuring module;

after completion of the operations for all of the subframes sourcing data to the restructuring module, issuing a control transaction to the restructuring module; and

performing operations upon the subframes sourced to the restructuring module in response to the control transaction.

12. (Previously presented) A computer readable medium having computer executable instructions for a digital computer to perform steps comprising the method of claim 11.

13. (Previously presented) The method of claim 11 where allocating the composite frame includes constructing a frame control table having an entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon the subframe.

14. (Previously presented) The method of claim 13 further comprising setting one of the flags whenever a module has completed an operation upon a subframe.

15. (Original) The method of claim 11 further including constructing an offset table specifying the structure of the subframes within the composite frame.

16. (Original) The method of claim 11 further comprising constructing a pipe control table specifying the structure of the modules in the pipe.

17. (Original) The method of claim 16 where the pipe control table has an entry for at least some of the modules in the pipe, and where each entry specifies which other module or modules source data to one of the modules in the pipe.

18. (Original) The method of claim 16 where the pipe control table has an entry for each module in the pipe that sources data from outside the pipe.

19. (Previously presented) The method of claim 11, wherein the pipe accommodates performance of operations upon a plurality of composite frames concurrently.

20. (Original) The method of claim 19 further comprising constructing a separate frame control table for each of the composite frames.

21. (Currently amended) A method for processing frames of streaming data through modules including multiple restructuring modules in a digital computer, comprising:

constructing a graph as a sequence of the modules for accepting and processing the frames of streaming data to achieve desired output data;

dividing the graph to define a pipe according to performance parameters for each of the modules and the graph as a whole, wherein each pipe is a connected group of multiple ones of the modules, at least one of the modules being a ~~including the~~ restructuring ~~modules~~ module and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules;

constructing at least one composite frame nesting tree specifying composite frames comprising nested subframes;

assigning a single allocator to one of the modules;

allocating composite frames in accordance with the at least one composite frame nesting tree with respective ones of the restructuring modules, wherein the allocating of the composite frames includes a frame control table having an entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe;

setting the flag whenever the particular module has completed the operation upon the particular subframe;

transporting the streaming data through different ones of the modules in the group in different ones of the subframes; and

restructuring the data among the subframes in the restructuring modules.

22. (Previously presented) A computer readable medium having computer executable instructions for a digital computer to perform steps comprising the method of claim 21.

23. (Previously presented) The method of claim 21, wherein the at least one frame nesting tree specifies how the data is restructured by respective ones of the restructuring modules.

24. (Original) The method of claim 21 further comprising collecting a constant-offset flag for each module.

25. (Original) The method of claim 24 further comprising collecting an offset value for any module whose constant-flag is set.

26. (Original) The method of claim 24 further comprising constructing an offset table specifying relationships of the subframes to the composite frame.

27. (Original) The method of claim 24 further comprising specifying memory sizes for each of the subframes within the composite frame.

28. (Original) The method of claim 21 where a plurality of the restructuring modules are of a single type in a cascade in the pipe.

29. (Original) The method of claim 28 where the allocator is assigned to a particular module in response to the type of cascaded modules.

30. (Original) The method of claim 28 where the plurality of cascaded modules are mixers, and where the allocator is assigned to a downstream one of the cascaded mixers.

31. (Original) The method of claim 28 where the plurality of cascaded modules are splitters, and where the allocator is assigned to an upstream one of the cascaded splitters.

32. (Original) The method of claim 21 where transporting the streaming data includes issuing control transactions to the restructuring modules only when all of the subframes processed by respective ones of the modules become available.

33. (Currently amended) A method for processing frames of streaming data through modules including multiple restructuring modules connected in a pipe in a digital computer, comprising:

constructing a graph as a sequence of the modules for accepting and processing the frames of streaming data to achieve desired output data;

dividing the graph to define the pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules;

constructing at least one composite frame nesting tree specifying at least one composite frame comprising multiple nested subframes;

allocating a composite frame in accordance with the at least one composite frame nesting tree for different ones of the restructuring modules, wherein the allocating of the composite frame includes a frame control table having an entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe;

setting the flag whenever the particular module has completed the operation upon the particular subframe;

performing data-sourcing operations upon certain of the subframes in source ones of the modules;

when each of the data-sourcing operations has completed, determining whether one of the restructuring modules has all of the subframes required for it to perform an operation;

if so, issuing a control transaction to the one restructuring module; and

performing an operation in the one restructuring module after receiving a control transaction.

34. (Previously presented) A computer readable medium having computer executable instructions for a digital computer to perform steps comprising the method of claim 33.

35. (Original) The method of claim 33 where the source ones of the modules are those receiving data from outside the pipe.

36. (Original) The method of claim 33 where a plurality of the restructuring modules are mixers.

37. (Original) The method of claim 36 where a plurality of the mixers are cascaded in the pipe.

38. (Currently amended) The method of claim 33 further comprising:

when each of the data-sourcing operations has completed, determining whether others of the restructuring modules have all of the subframes required for them to perform operations;

if so, issuing control transactions to the other restructuring modules; and

performing operations in the other restructuring modules after receiving the control transactions.

39. (Currently amended) The method of claim 33 further comprising:

storing a separate completion flag for each of the modules in the pipe; and

setting one of the completion flags when a corresponding one of the modules has completed an operation upon a corresponding subframe.

40. (Currently amended) The method of claim 39 where the determining step comprises:

reading a table listing all of the other modules that source data to the one restructuring module; and

determining whether a completion flag for all of the other modules has been set.

41. (Previously presented) The method of claim 33, wherein the pipe accommodates performance of operations upon a plurality of composite frames concurrently.

42. (Original) The method of claim 41 further comprising constructing a separate frame control table for each of the composite frames.

43-56 (Canceled).

57. (Currently amended) A computer system for processing streaming data, comprising:

a plurality of modules for processing the streaming data, at least some of which are restructuring;

a plurality of memory managers each configured to, at least:

construct at least one composite frame nesting tree specifying composite frames comprising nested subframes for containing streaming data; ~~and~~

allocate composite frames in accordance with the at least one composite frame nesting tree, wherein the allocating of the composite frames includes a frame control table having an entry for each module in a pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe; and

set the flag whenever the particular module has completed the operation upon the particular subframe; and

a flow manager for constructing a graph as a sequence of the modules for accepting and processing the streaming data to achieve desired output data, for dividing the graph to define [[a]] the pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules, including a plurality of the restructuring modules, and for assigning one of the memory managers to the pipe and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules.

58. (Previously presented) The system of claim 57 further comprising a common memory area for storing the composite frames.

59. (Previously presented) The system of claim 58 where the subframes are allocated within the composite frames in the common memory area.

60. (Original) The system of claim 58 further including a processor.

61. (Original) The system of claim 60 where the processor implements one of more of the restructuring modules.

62. (Original) The system of claim 60 further including an input/output system.

63. (Original) The system of claim 62 where the input/output system implements one or more of the modules.

64. (Original) The system of claim 57 further comprising a pipe manager for constructing representation of the structures of the composite frames.

65. (Original) The system of claim 64 where one of the representations specifies location of the subframes with respect to the composite frame.

66. (Original) The system of claim 64 where one of the representations specifies relationships of the modules within the pipe.

67. (Original) The system of claim 57 further including a control manager for transporting the streaming data through the modules in various ones of the subframes.

68. (Original) The system of claim 67 where the control manager issues a control transaction to one of the restructuring modules for initiating processing of a subframe therein only when all of the subframes processed by that module become available.

69. (Currently amended) A computer system for processing streaming data, comprising:

a plurality of modules for processing the streaming data, at least some of the modules being restructuring;

a plurality of memory managers each configured to, at least:

construct at least one composite frame nesting tree specifying composite frames comprising nested subframes for containing streaming data~~, different ones of the subframes being associated with different ones of the modules~~; ~~and for allocating~~

allocate composite frames in accordance with the at least one composite frame nesting tree, wherein the allocating of the composite frames includes a frame control table having an entry for each module in a pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe; and

set the flag whenever the particular module has completed the operation upon the particular subframe;

a flow manager for constructing a graph as a sequence of the modules for accepting and processing the streaming data to achieve desired output data, for dividing the graph to define the pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules, including a plurality of the restructuring modules, and for assigning one of the memory managers to the pipe and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules; and

a control manager for issuing control transactions for initiating processing operations in the modules.

70. (Original) The system of claim 69 where the control manager issues one of the control transactions to a particular module only when certain of the subframes associated with that module become available.

71. (Original) The system of claim 70 where the certain subframes include all of the subframes that source data to the particular module.

72. (Original) The system of claim 69 where certain of the modules receive data from outside the pipe.

73. (Original) The system of claim 72 where the control manager issues a control transaction to the certain modules when one of the composite frames has been allocated.

74. (Original) The system of claim 69 where at least some of the restructuring modules are mixers for combining multiple ones of the subframes.

75. (Original) The system of claim 74 where a plurality of the mixers are cascaded in the pipe.

76. (Original) The system of claim 75 where the control manager issues one of the control transactions to any of the mixers only when all of the subframes combined by that mixer become available.

77. (Previously presented) The system of claim 69 further comprising a common memory area for storing the composite frames.

78. (Previously presented) The system of claim 77 where a processor implements one or more of the restructuring modules.

79. (Original) The system of claim 78 further including an input/output system implementing one or more of the modules.

80. (Currently amended) A computer readable medium bearing instructions and data for causing a digital computer to execute a method for processing frames of streaming data through modules in a digital computer, the method comprising:

constructing a graph as a sequence of the modules for accepting and processing the frames of streaming data to achieve desired output data;

dividing the graph to define a pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules, at least one of the modules being ~~restructuring~~ a restructuring module and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules;

providing a common memory area accessible to the modules within the pipe for storing streaming data;

constructing a composite frame nesting tree specifying composite frames comprising nested subframes;

allocating composite frames in the common memory area in accordance with the composite frame nesting tree, wherein the allocating of the composite frame includes a frame control table having an entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe;

setting the flag whenever the particular module has completed the operation upon the particular subframe;

transporting the streaming data through different ones of the modules in the group in different ones of the subframes; and

restructuring the data among at least some of the subframes in the restructuring module.

81. (Currently amended) A computer readable medium bearing instructions and data for causing a digital computer to execute a method for processing frames of streaming data through multiple modules disposed in a pipe in a digital computer, the method comprising:

constructing a graph as a sequence of the modules for accepting and processing the frames of streaming data to achieve desired output data;

dividing the graph to define the pipe according to performance parameters for each of the modules and the graph as a whole, wherein the pipe is a connected group of multiple ones of the modules, at least one of the modules being a restructuring module and wherein the performance parameters comprise parameters corresponding to operations performed by graph modules;

constructing a composite frame nesting tree specifying a composite frame comprising multiple nested subframes;

allocating a composite frame in accordance with the composite frame nesting tree, wherein the allocating of the composite frame includes a frame control table having and entry for each module in the pipe and a flag for each of the modules indicating whether a particular module has completed an operation upon a particular subframe;

setting the flag whenever the particular module has completed the operation upon the particular subframe;

performing operations upon the subframes in any of the modules sourcing data to the restructuring module;

after completion of the operations for all of the subframes sourcing data to the restructuring module, issuing a control transaction to the restructuring module; and

performing operations upon the subframes sourced to the restructuring module in response to the control transaction.

82. (Previously presented) The method of claim 1, wherein a nesting of the nested subframes corresponds to the graph topology.

83. (Previously presented) The method of claim 82, wherein the nesting of the nested subframes corresponds to a location of the at least one restructuring module in the graph topology.

84. (Previously presented) The method of claim 83, wherein a subframe nesting occurs for each instance of a restructuring module in the graph topology.

85. (Previously presented) The method of claim 1, wherein the performance parameters comprise parameters corresponding to operations performed by graph modules.

86. (Previously presented) The method of claim 1, wherein the performance parameters comprise parameters corresponding to operations performed by the graph as a whole.

87. (Previously presented) The method of claim 1, wherein the performance parameters comprise topology suggestions.

88. (Previously presented) The method of claim 1, wherein allocating composite frames in accordance with the composite frame nesting tree comprises utilizing the composite frame nesting tree to resolve frame allocation dependencies.

89. (Previously presented) The method of claim 1, further comprising:

constructing at least one further composite frame nesting tree; and

allocating composite frames in accordance with each of the composite frame nesting trees.

90. (Previously presented) The method of claim 1, wherein the composite frame nesting tree is a unique nesting tree for the graph.